class. They found that their company duties were easy compared to the efforts they would have to exert to obtain a passing grade in their school work. A number of these men had had very litttle, if any, high-school work and they hardly realized what it meant to exert themselves mentally. Men who had less than eighth-grade school work were not accepted as students, as the instructors did not have time to teach them the subjects that were necessary before they could enter the regular class in the meteorological course. Those who were high-school graduates or had had high-school training were preferred, although it was found that a few of the men with more limited school training made some of the best students. A few having some college training were enrolled in the class and they were often used as assistants to aid some of the other men who were slow in understanding the work.

Meteorology is a comparatively new subject as far as its broad applications to the Army are concerned, and this is perhaps the main reason that there was very little interest manifested in the meteorological course in the school at the beginning, except among the officers who are engaged in that branch of the work or among the few who understood the applications of meteorology to military duties. During the latter part of the year more interest was noticeable, due, no doubt, to the campaign of education carried on throughout the Army and also to the increasing number of men who had taken the course in the school and had been sent to the Signal Corps stations where they had interested others in meteorology. Several officers at the camp, after seeing what was being done and having the work explained to them, expressed a desire to enter the meteorological section as soon as an officer's course could be started. It is the aim of the Signal Corps to get as large a number in the school taking meteorology as the accommodations will permit in order that the graduates may man the new stations to be established and fill vacancies on those already in operation. Also arrangements are being made to start an officer's training course in the school as an extension of the work will require men of supervisory ability, and these men will be able to carry on the meteorological wo
Army, which then will not have to rely on other branches of the Government for properly trained men in times of emergency.

551.465.7: 551.524 (27)

SURFACE-AIR AND WATER TEMPERATURES AT WESTERN BANK OF GULF STREAM.

An example of the influence of ocean surface water temperature on that of the overlying air stratum is afforded by a series of air and water temperatures readings submitted to the Weather Bureau by Mr. H. T. Broere, formerly meteorological observer on the Dutch S. S. *Rotti*.

During a voyage of the *Rotti* from Colon to New York in March, 1919, Mr. Broere made a series of hourly readings of the air and water temperatures while the vessel was traveling in the Antilles branch of the equatorial current and the Gulf stream, and after passing from the latter into the cold waters of the Labrador current northeast of Cape Hatteras, the observations covering a period of some 80 hours.

The temperatures observed while the vessel was in the warm waters of the Gulf stream and when passing the "cold wall" are shown in figure 1, in which have been plotted the readings, both air and water, at intervals of

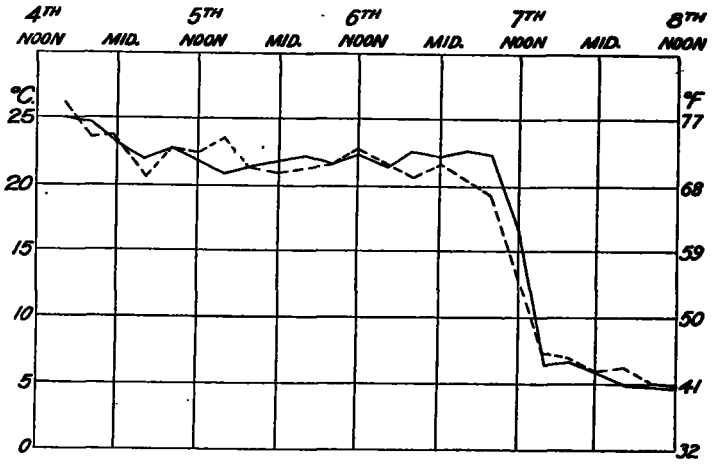

FIG. 1.—Temperatures of air and water observed by the *Rotti* when passing from the warm waters of the Gulfstream (dotted=air temperature; solid=water temperature.

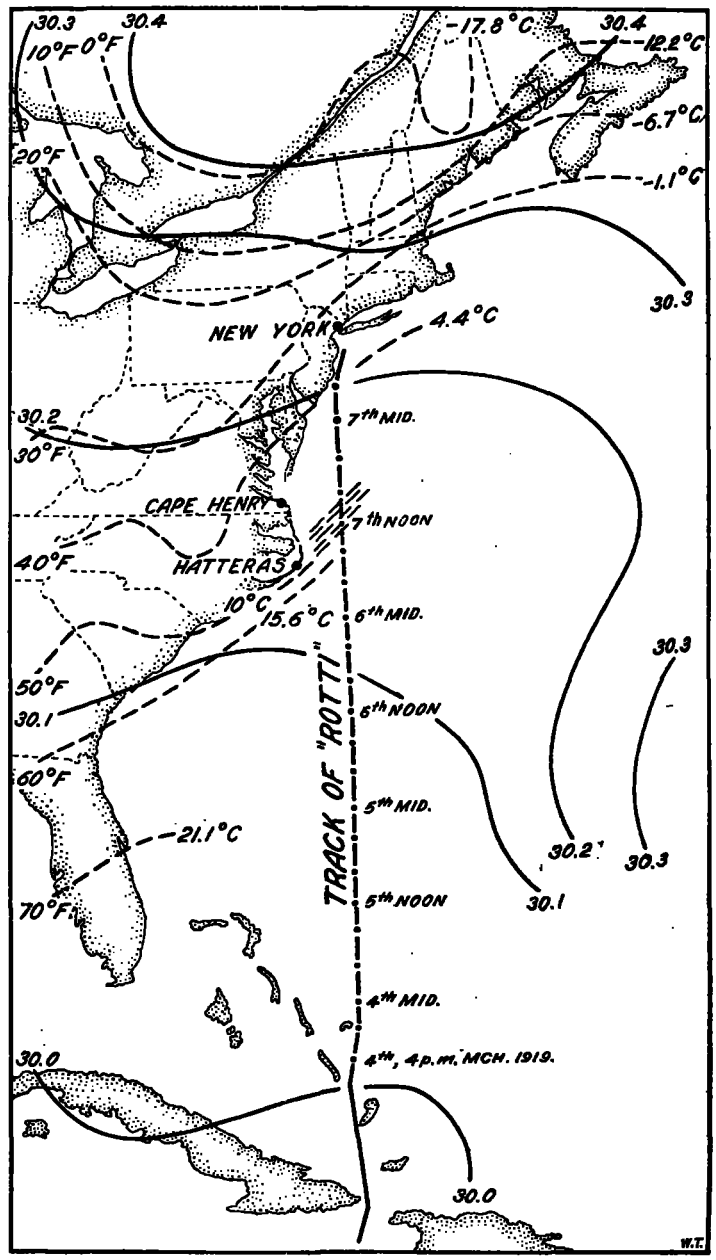

FIG. 2.—The track of the *Rotti* and the pressure and temperature conditions in eastern United States and Canada at 8 a. m. (75th mer. time), March 7, 1919.

four hours. In figure 2 are shown the track of the *Rotti* and the general pressure and temperature distribution for the eastern United States and Canada at 8 a. m. (75th meridian time) on March 7.

The striking similarity in the rate of change of the temperature of the air with that of the water was occasioned, doubtless, from the circumstance of a wind blowing nearly parallel to the course of the Gulf stream, although in the opposite direction.

According to the Daily Journal of the *Rotti* the day of March 7 opened with overcast skies. At 5 a. m. the wind suddenly shifted from SSW., 4, to NNW., 3, gradually becoming NE., 4.

At the Weather Bureau station at Hatteras the wind was NE. from midnight of the 6th to 3 a. m. of the 7th, N. from 4 to 11 a. m., NE. from 11 a. m. to noon, N. from noon to 7 p. m., NE. from that hour to midnight. The average hourly velocity was 16 miles. At the Cape Henry station the prevailing wind direction for the 7th was NE.; average hourly velocity, 11 miles.

The effect of the wind blowing so nearly parallel to the course of the ocean currents was to permit the surface air to take on the temperature of the water, thus forming a cold-air wall quite as distinct as the cold-water wall beneath.—*F. G. Tingley.*

551.578.1 (26)

OCEAN RAINFALL.

By H. G. CORNTHWAITE.

[Rockville, Ind.]

It is the writer's belief that the average rainfall over ocean areas is often overestimated, especially in the Tropics, where cyclonic storms seldom occur and where most of the rainfall is of convectional origin. Convectional air circulation in the Tropics is much more pronounced over land areas than over the oceans, and the average rainfall over and adjacent to land areas is correspondingly heavier than the rainfall farther out at sea.

Actual records of ocean rainfall are difficult to obtain. Records from moving vessels would be of questionable accuracy and doubtful value. The usual method is to estimate the ocean rainfall from adjacent coast and island records. In following this method due allowance should be made for the heavier rainfall over land areas due to (1) increased convectional air circulation and (2) the upward deflection of the winds in passing over the land.

Personal observations covering a number of voyages to and from the Tropics seem to confirm the belief that both cloudiness and rainfall are very much lighter over tropical ocean areas than over the surrounding land. No matter how fair the weather at sea, one seldom sails through the Windward Passage without noting the high-topped, dense-based cumulus or cumulo-nimbus clouds surmounting Cuba, Haiti, and other large islands of the West Indies. Frequently the larger islands can be located by the overhanging clouds long before land is in sight.

Intermittent, squally showers are frequently encountered in the Caribbean Sea, but there are few torrential downpours such as occur over the surrounding tropical lands. Even with the passage of a West Indian hurricane the heaviest rainfall may be expected on the windward slope of the higher land areas in the path of the storm.

WATERSPOUT AT SAN JUAN, P. R.

W. C. HAINES, Observer.

[Weather Bureau, San Juan, P. R., Feb. 26, 1921.]

A waterspout was observed at San Juan, P. R., on the evening of January 29, 1921. Although this waterspout was not so striking in appearance as some, the conditions under which it developed and the manner in which it disappeared were nevertheless interesting. It occurred in connection with a moderate squall which had formed north of the station and was moving rapidly toward the southeast. When first seen by the writer, at about 6:15 p. m., the waterspout was northeast of the station at a distance estimated to be from 3 to 5 miles, and was moving rapidly southeastward toward the shore line. The funnel-shaped cloud appeared to be suspended nearly vertically from a dark mass of storm cloud, and it extended approximately halfway down to the surface of the water. The spout gradually shortened and became less dense along its vertical axis as the shore was approached. By the time it had moved inland (about 10 minutes after it was first observed) the spout had shortened to perhaps half its original length, and had "thinned out" vertically to such a degree that its outer edges appeared as two separate spouts. By 6:30 p. m. all evidences of the waterspout had entirely disappeared.

The waterspout probably never reached that stage of development where the funnel-shaped cloud extended to the surface of the water, as Mr. Parker, observer at this station, saw what he supposed to be the first evidences of the formation of the spout only a few minutes before it was first observed by the writer. As described by him, it appeared as a slight projection on the base of the storm cloud. No indications of a disturbance in the water below the spout could be detected at any time during its existence, nor could a spiral motion be discerned within or about the funnel-shaped cloud.

The pilot balloon observation on the morning of the 29th showed favorable conditions for the formation of squalls. The winds were southerly up to about 1,250 meters, where they shifted abruptly from SSE. to WNW. and continued westerly or northwesterly to an elevation of approximately 10,500 meters, the elevation at which the balloon disappeared. On the average, in this latitude (18° 29′ N.) westerly winds are not encountered below the 6,000-meter level. The barometric pressure increased from 29.98 inches at 9 a. m. of the 29th to 30.08 inches at 9 a. m. of the 30th. The surface winds were light during the day, shifting from southwest to northwest at 11:15 a. m. and continuing from the northwest or north until 9 p. m. The highest velocity recorded during the prevalence of the squall was 19 miles from the northwest at 6:12 p. m. The noon observation showed intermediate clouds from the northwest and lower clouds from the southeast. A trace of rain occurred between 5:10 p. m. and 6:05 p. m.

This is the third waterspout that has been observed at this station within a period of less than 18 months. The other two occurred in connection with thunderstorms.